CONNECTION OF SIEMENS PLC TO LABVIEW USING OPC

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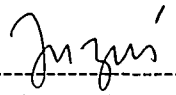

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A thesis submitted
as partial in fulfilment of the requirements for the award
of the degree of Master of Electrical Engineering

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"I declared that this thesis entitled '**Connection of Siemens PLC to LabVIEW using OPC**' is the result of my own research except as cited in references."

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Date : 22 NOVEMBER 2004

DEDICATION

For those who pray my success and
For those waiting for my success

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ABSTRACT

The project is to enable the Siemens PLC (Programmable Logic Control) S7-300 to communicate with the LabVIEW. The communication between S7-300 and LabVIEW is via OPC (OLE for Process Control).Development of OPC using SIMATIC NET OPC Server. OPC is industry standard provides real plug-and-play software technology for process control and factory automation. OPC integrate software and hardware across spectrum of vendors easily. Visualization of Festo Didactic process developed using LabVIEW. Festo Didactic is small system which consist actuators and sensors .The process of Festo is to make hole for three different material red plastic, black plastic and metal. PROFIBUS is a medium to transfer data from PLC to LabVIEW or LabVIEW to PLC.

ABSTRAK

Projek ini membolehkan komunikasi di antara Siemens PLC (Programmable Logic Control) S7-300 dengan LabVIEW. Komunikasi di antara PLC dengan LabVIEW adalah melalui OPC (OLE for Process Control). Pembangunan OPC menggunakan SIMATIC NET OPC Server.OPC adalah industri standard yang memberikan keadaan sebenar plug-and-play teknologi perisian untuk kawalan process dan automasi industri.. OPC juga mengintegrasikan perisian dan perkakasan bagi semua pembekal dengan mudah. Visualisasi proses Festo Didactic dibangunkan dengan menggunakan LabVIEW. Festo Didactic adalah system kecil yang mengandungi banyak pengesan dan pengerak. Proses yang dijalankan oleh Festo adalah melubangkan tiga jenis bahan iaitu plastik berwarna merah, plastic berwarna hitam dan juga logam.PROFIBUS adalah media yang digunakan untuk menghantar data dari PLC ke LabVIEW atau LabVIEW ke PLC.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

DDE	-	Dynamic Data Exchange
DP	-	Decentralized Periphery
FBD	-	Function Block Diagram
FMS	-	Fieldbus Message Specification
I/O	-	Input/Output
LabVIEW	-	Laboratory Virtual Instrument Engineering Workbench.
LAD	-	Ladder Logic
LED	-	Light Emitting Diode
MPI	-	Multipoint Interface
OLE	-	Object Linking and Embedding
PC	-	Personal Computer
PCI	-	Peripheral Component Interconnect
PLC	-	Programmable Logic Control
PROFIBUS	-	Process Field Bus
STL	-	Statement List
TCP/IP	-	Transmission Control Protocol / Internet Protocol
VI	-	Virtual Instrument
WinCC	-	Window Control Centre

LIST OF APPENDICES

CHAPTER I

INTRODUCTION

Traditionally, the industrial automation market has seen a proliferation of proprietary interface standards. Hundreds of different and incompatible proprietary interface standards developed by suppliers are required to communicate with automation systems and devices. There is a barrier because of incompatibilities and proprietary communication interfaces between different suppliers' automation hardware and software [19].Using proprietary interface method locked users into particular vendor. If users required changes in system, users were forced to return to the same vendor and subsequently forced to pay for solutions that were not always optimal. Creating a multivendor system, in automation company which can choose and apply the best products and systems for any given application often requires to invest a significant amount of money on system integration. The money invested is not just to get the desired automation and control functionality from the system. Much effort is required to ensure that the systems, can share information and interoperate with other automation and business systems in the plant or factory.

OPC *(OLE for Process Control)* removes barriers between traditionally proprietary factory floor devices, systems and other manufacturing software. OPC is open connectivity in industrial automation and the enterprise systems that support industry [19]. The standard that enables integrators to connect disparate systems together, creating robust solutions and providing true interoperability; while at the same time reducing

implementation time and costs. Interoperability is assured through the creation and maintenance of open standard specifications [19]. The OPC enables a fully scalable solution for future changes and expansion. The users no longer tied or locked in to a single vendor. In addition, long-term maintenance and upgrading can be done by removing and replacing individual components in a system without any work needed to "wire up" the new pieces [19]. The advantage of OPC to supplier is reducing their time in driver development so they focus on at communication to end device, rather than worrying about different client communication schemes [19]. At the end, vendor become more competitive and offer superior product and solution to maintain their products and customers.

1.1 Problem Statement

Now day, application software should readily communicate with digital plant-floor devices as well as other applications. Most manufacturers pressing need of making hardware and software work together. The main problem of manufacturers is interfaces not standard. The proprietary system not integrates among each other.

In the absence of any standard, vendors have developed proprietary hardware and software solutions. Integrating different systems increase cost to manufacturer as well as long term maintenance and support. The custom drivers and interfaces can be written, but day by day thousands of different types of control devices and software packages increases rapidly. The other problem faces by manufactures are inconsistencies among different vendors' drivers, hardware features that are not universally supported, hardware upgrades that can wreck an existing driver, and access conflicts. When supplier comes out with new controller, software developers have to write a new driver. Each time manufacturer purchase new controller then they also has to buy new driver for the controller. This problem adding manufacturer costs.

All the problem should be solve of getting a variety of systems to work together. The solution is having a standard that provides real plug-and-play software technology for process control and factory automation for every system, every device and every driver can freely communicate, connect and integrated. The standard is OPC *(OLE for Process Control)* where OLE is Object Linking and Embedding.

Formerly student at Georg-Simon Ohm, Fachhochshule Nürnberg, Germany develop a proprietary which Siemens PLC (S7-300) with Siemens software, WinCC *(Window Control Centre)*. The OPC verified through this project which Siemens PLC (S7-300) integrated with LabVIEW.

1.2 Project Overview

Figure 1.1 shows the overview of the project. This project developed using a small factory automation called Festo Didactic. Important of the project is used OPC as the connection between Siemens PLC (S7-300) and LabVIEW. The Computer1 consist OPC which OPC Server configured by SIMATIC NET. The SIMATIC NET is software from Siemens to develop OPC Server. LabVIEW as OPC Client and also as visualization interface for Festo Didactic. Festo Didactic is small system consist sensors, actuators and stepper motors. The connection Computer1 to S7-300 is via PROFIBUS. To enable this communication, a module card CP5611 installed at Computer1. The CP5611 installed at any free PCI *(Peripheral Component Interconnect)* slot on the Computer1. The PLC connects directly to sensors, actuators and stepper motors at Festo Didactic. The Computer2 configured hardware S7-300 and connection via MPI *(Multipoint Interface)* and PROFIBUS. The Computer2 created PLC programming via STEP7. The STEP7 is software from Siemens to write a Siemens PLC programming. The description of Festo will discuss on Chapter 5 on Hardware specifications.

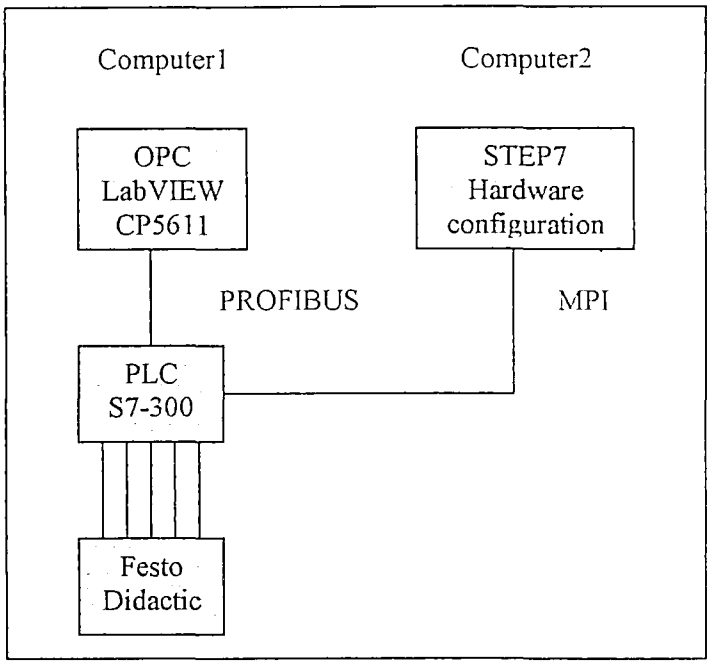

Figure 1.1: The connection between S7-300 and LabVIEW via OPC

1.3 Project Aim

The aim of this project is to develop an OPC for Festo Didactic

1.4 Objectives

The objectives of the project are:-

1. Develop OPC Server and OPC Client.
2. Enable the connection from Computer to Siemens PLC (S7-300) through PROFIBUS (RS485).
3. Develop the visualization for the Festo Didactic using LabVIEW.
4. Enhancing PROFIBUS (RS485) from 1.5 Mbps to 12 Mbps.
5. Performance Test and find out the limitations

1.5 Project Scope

The project concentrated development on OPC, LabVIEW and CP5611 module card. The project also concentrated on transmission technology via PROFIBUS (RS485). The formerly student, at Georg-Simon-Ohm, Fachhochshule Nürnberg, Germany has been done development on Siemens PLC (S7-300) to Festo Didactic, WinCC *(Window Control Centre)* and MPI connection.

CHAPTER II

THEORETICAL BACKGROUND

2.1 OPC *(OLE for Process Control)*

As Computer becomes more and more important even in industrial automation. Most Computer interface based on Microsoft Windows technologies. The first solution provided with Microsoft 3.1 was the Dynamic Data Exchange (DDE). Although an open and finally widely accepted standard its communication performance was not satisfactory. The development of the OPC (OLE for Process Control) architecture aims at solving the question of performance while providing an open interface standard between application.

2.1.1OPC Background

A standard mechanism for communicating to numerous data sources, either devices on the factory floor, or a database in a control room is the motivation for OPC. The architecture for the Process Industry shown in Figure 2.1 involves the following levels:

1. Field Management is to provide data on the health of a device, its configuration parameters, materials of construction, etc. The data must be presented to the user, and any applications using it, in a consistent manner.